

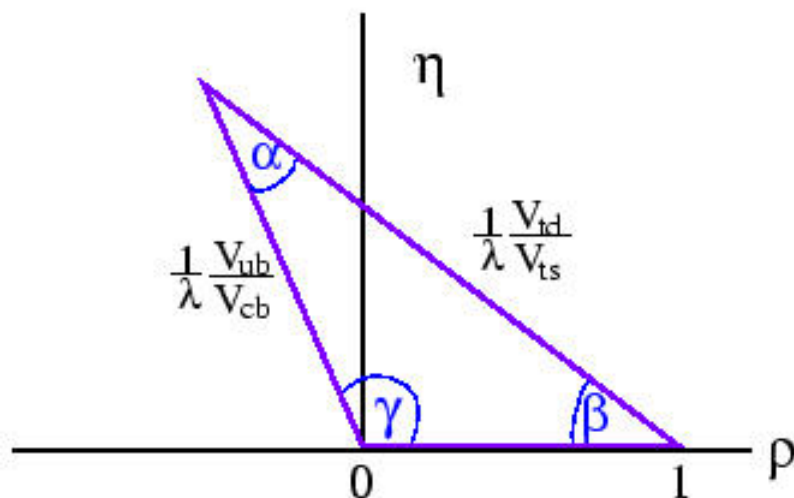
Status of BTeV

Talk to P5
July 21, 2004
Joel Butler
Fermilab

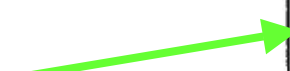
- The Evolving Physics Case
- Recent Developments from Reviews Past
- The staged schedule
- The new BTeV IR
- BTeV IR and Commissioning
- LHCb/BTeV Startup issues
- Test Beam Activities and Plans
- Conclusion

- Emphasis now is on New Physics (NP) Beyond the Standard Model (BSM)
 - Standard Model Constraints on CP violation and rare decays are very specific
 - There is a reasonable subset of decays that are theoretically clean I.e. negligible or manageable theoretical uncertainties
 - New Physics scenarios almost all have additional freedom in the flavor sector, such as new phases, that can modify the SM picture
- New Physics could be seen for the first time in B decays **or, what is now considered more likely, as new physics is found at the Tevatron and LHC, the implications for B physics of various explanations can be worked out and looked for. B physics can help to resolve what many feel will be a complicated picture. B physics may permit one to eliminate some interpretations and to pin down the parameters of others. In particular, B physics is sensitive to new phases.**

Key Measurements of the CKM matrix in B Decays



$$\chi = \arg\left(-\frac{V_{cs}^* V_{cb}}{V_{ts}^* V_{tb}}\right)$$



Physics Quantity	Decay Mode
$\sin(2\alpha)$	$B^0 \rightarrow \rho\pi \rightarrow \pi^+\pi^-\pi^0$
$\cos(2\alpha)$	$B^0 \rightarrow \rho\pi \rightarrow \pi^+\pi^-\pi^0$
$\text{sign}(\sin(2\alpha))$	$B^0 \rightarrow \rho\pi, B^0 \rightarrow \pi^+\pi^-$
$\sin(\gamma)$	$B_s \rightarrow D_s K^-$
$\sin(\gamma)$	$B^+ \rightarrow D^0 K^+$
$\sin(\gamma)$	$B \rightarrow K\pi$
$\sin(\gamma)$	$B \rightarrow \pi^+\pi^-, B_s \rightarrow K^+K^-$
$\sin(2\chi)$	$B_s \rightarrow J/\psi\eta', J/\psi\eta$
$\sin(2\beta)$	$B^0 \rightarrow J/\psi K_s$
$\sin(2\beta)$	$B^0 \rightarrow \phi K_s, \eta' K_s, J/\psi\phi$
$\cos(2\beta)$	$B^0 \rightarrow J/\psi K^*, B_s \rightarrow J/\psi\phi$
x_s	$B_s \rightarrow D_s\pi^-$
$\Delta\Gamma$ for B_s	$B_s \rightarrow J/\psi\eta', K^+K^-, D_s\pi^-$

About 1/2 of the key measurements are in B_s decays. About 1/2 of the key measurements have π^0 's or γ 's in the final state!

BTeV addresses these issues.

- P5

“P5 supports the construction of BTeV as an important project in the world-wide quark flavor physics area. Subject to constraints within the HEP budget, we strongly recommend an earlier BTeV construction profile and enhanced C0 optics.”

- Office of Science 20-Year Facilities Report

Priority: 12 Near Term – Important, Ready

BTeV

What’s New: BTeV will use state-of-the-art detector technologies and the very high particle production rates at Fermilab’s Tevatron to obtain the large samples of B-particles needed to make the necessary measurements.

- DOE Critical Decision 0 (CD-0)

CD-0, Approve Mission Need

for the

BTeV Project

at Fermi National Accelerator Laboratory

“We were informed the BTeV CD-0 has been approved by Ray Orbach on Feb. 17”

- **BTeV appears in the President’s 2005 Budget**

- The summary recommendations from the Lehman CD-1 review
 - “The committee concluded that the technical scope and cost estimate are ready for CD-1;”
 - “however the schedule will require additional effort. The committee supported the proposed technical scope. Most of the systems are technically sound and will likely meet the performance specifications.”
 - “Develop a schedule and funding profile for BTeV, such that the desired scientific capabilities are obtained while ensuring that the scientific output is competitive and timely. Provide revised plans to DOE as soon as possible, to support the CD-1 decision process.”

What caused the problems in the schedule

- The schedule that showed us coming on in 2009 was presented to P5 in the spring of 2003. It is connected to the projected end of Run 2 and a consistent picture has been shown by the lab at each presentation of the overall schedule, the Run 2 schedule, and the BTeV schedule.
- The new element is that the Lehman review concluded that we did not have enough schedule contingency to be reasonably certain that we could meet the schedule for the 2009 startup. Root causes are:
 - **The lab funding profile, given to BTeV, has too much money in the last year (FY09), ~\$40M. Purchases made with that money cannot have a large schedule contingency for an installation starting in summer 2009**
 - **The President's budget for 2005 provides significantly less money than the Fermilab guidance, causing some projects to get off to a late start.**
- One solution is to simply delay BTeV startup to gain the desired float. But this puts BTeV further behind LHCb -- a sort of Catch 22

- We were asked to submit a new schedule, but with the same approximate budget profile that provided “adequate” (~9 months) schedule contingency for all systems and had adequate time for installation. This was to be done by June 15th
- The staging plan responds to this puzzle by getting BTeV on the air on the original schedule with a “partial” detector that is competitive with, in fact superior to, LHCb. Most of the deferred systems provide BTeV with essentially unique capability so the delay is not causing it to lose ground to its competition.

- Staged Installation of the Detector: The detector will be installed in two stages
 - The first stage will be installed in a shutdown from August 1, 2009 to November 30, 2009 to be followed by a 7 month run.
 - The second stage will be installed in a shutdown beginning in early July of 2010 and lasting 3 months until Sept. 30, 2010.
- **Impact of Additional Resources: \$7.5 M forward funding from Syracuse University, contribution of \$7.5M from INFN to construct the Silicon Strip detector and to provide for the Italian groups' contribution to both the straw and pixel systems. We have just received an additional \$1M of forward funding from Wayne State. Other forward funding is likely.**
- Reallocation of resources within the project
- Adoption of explicit recommendations and suggestions from the review
- Effect of more work on specific issues raised in the review
- More total time for installation
- Scrubbing of the whole schedule

- The Staged Installation achieves four key goals
 - Provides much more “float” since 2009 budget authority can produce results that have significant float with respect to the second installation stage.
 - Provides significantly more time for installation because of the two shutdowns – 30 weeks vs 17 in the schedule presented at the CD-1 Review
 - Provides additional safety margin for Lead Tungstate Crystals in case their arrival is delayed by CMS’ problems
 - Provides a fully competitive, indeed superior , detector with respect to LHCb on schedule in 2009 (discussed in talk by Sheldon Stone).

Beginning in August 2009 when Run 2 ends, the Tevatron schedule will be set based on BTeV’s needs.

“During the Committee’s conference call to discuss the revised schedule there was general consensus that the BTeV team’s creative, substantive and rapid turnaround efforts has resulted in a credible and reasonable revised schedule for meeting the overarching goals of the project. The staged approach and the roughly doubled installation time are significant improvements and have greatly increased schedule float in almost all project activities. The revised funding profile (Appendix B) also has significantly more contingency in each year.”

“The committee found the proposed schedule for the construction of the detector is reasonable and appropriate in view of the technical risks and proposed funding profiles.”

“The committee unanimously agreed that the critical path has been identified in all subsystems....”

“In summary, the Committee concludes that the revised plan for BTeV construction has a much higher probability of success for completion than the plan presented at the April CD-1 review, and, therefore, finds the BTeV construction Project ready for CD-1.”

- Electromagnetic Calorimeter – possible conflict with CMS' procurements of lead tungstate
- Length of time to commission the experiment might cut into physics of the first run
- Installation Schedule still “aggressive”. (But we use only single shift operation 5 days/week. We have added money to the budget contingency to cover double shift operations 6 days/week if necessary)

We will address the crystal procurement and commissioning issues a little later

“The proposed staging preferentially maintains charged-mode capabilities in order to remain competitive in areas of LHCb’s relative strength. Even so, BTeV will have significant physics capabilities in neutral modes, where LHCb is less capable during Stage 1. By the summer of 2010, BTeV could have acquired about 1.0 fb^{-1} with their Stage 1 detector, and LHCb could have 1.8 fb^{-1} . The committee reviewed a series of physics studies that compare initial results from a staged BTeV to LHCb. The results of these studies show that BTeV will become the superior experiment essentially as soon as BTeV data are available. Since LHCb will be online 1-2 years before BTeV, LHCb will have some opportunities for new physics discoveries. However, this statement is true even if BTeV is not staged.”

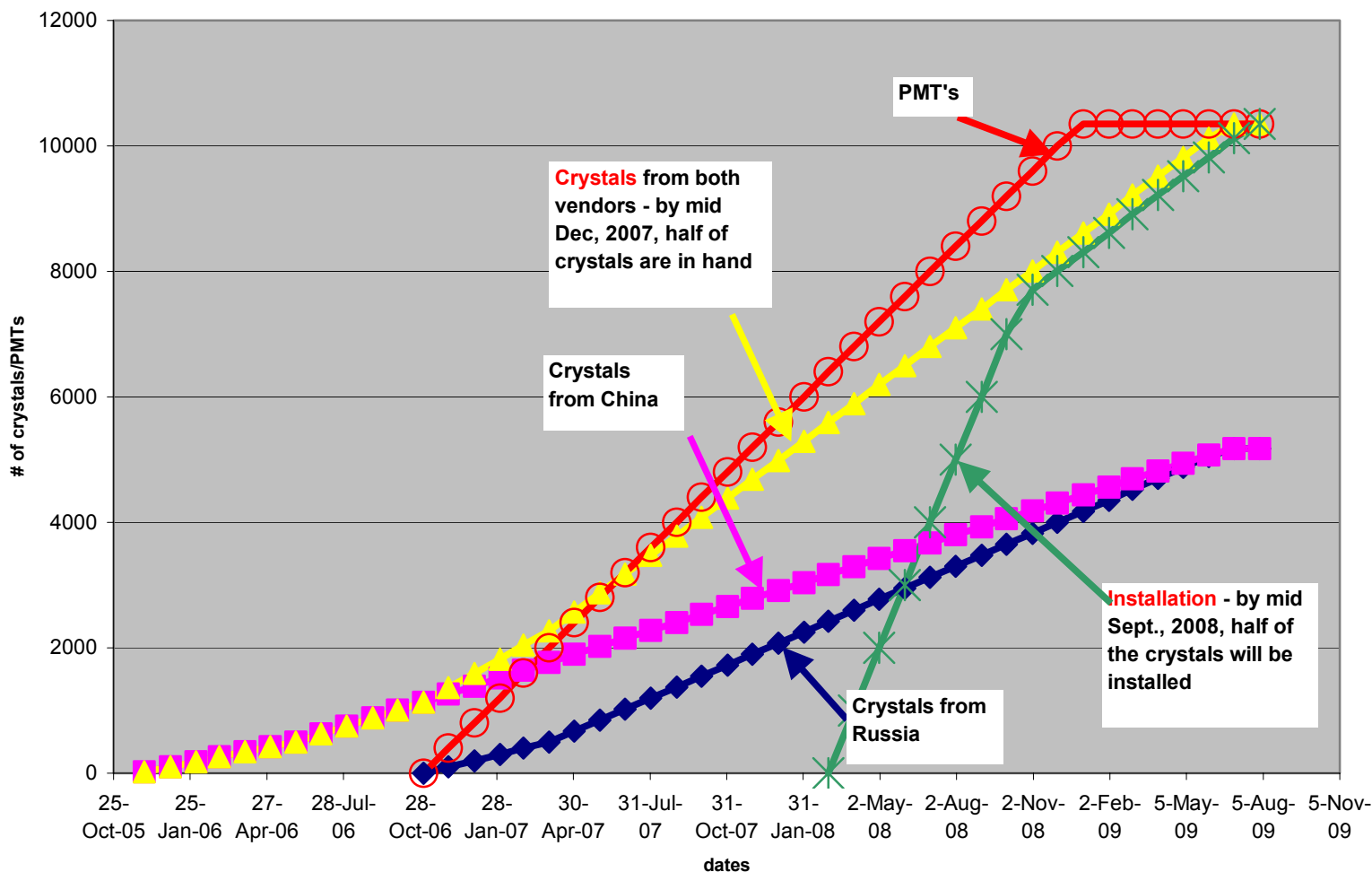
“The Committee finds the studies presented to be sound. The Committee expects BTeV to be competitive with LHCb as soon as BTeV starts analyzing data, Giving it a good chance to participate in the initial measurements, which should Have significant discovery potential. The Committee reiterates that nothing in The staged schedule will affect the expected superiority of BTeV on a wide Range of compelling heavy flavor physics topics. In light of these findings, The Committee unanimously endorses the staging plan for BTeV.”

You will hear more about the PAC in a latter talk

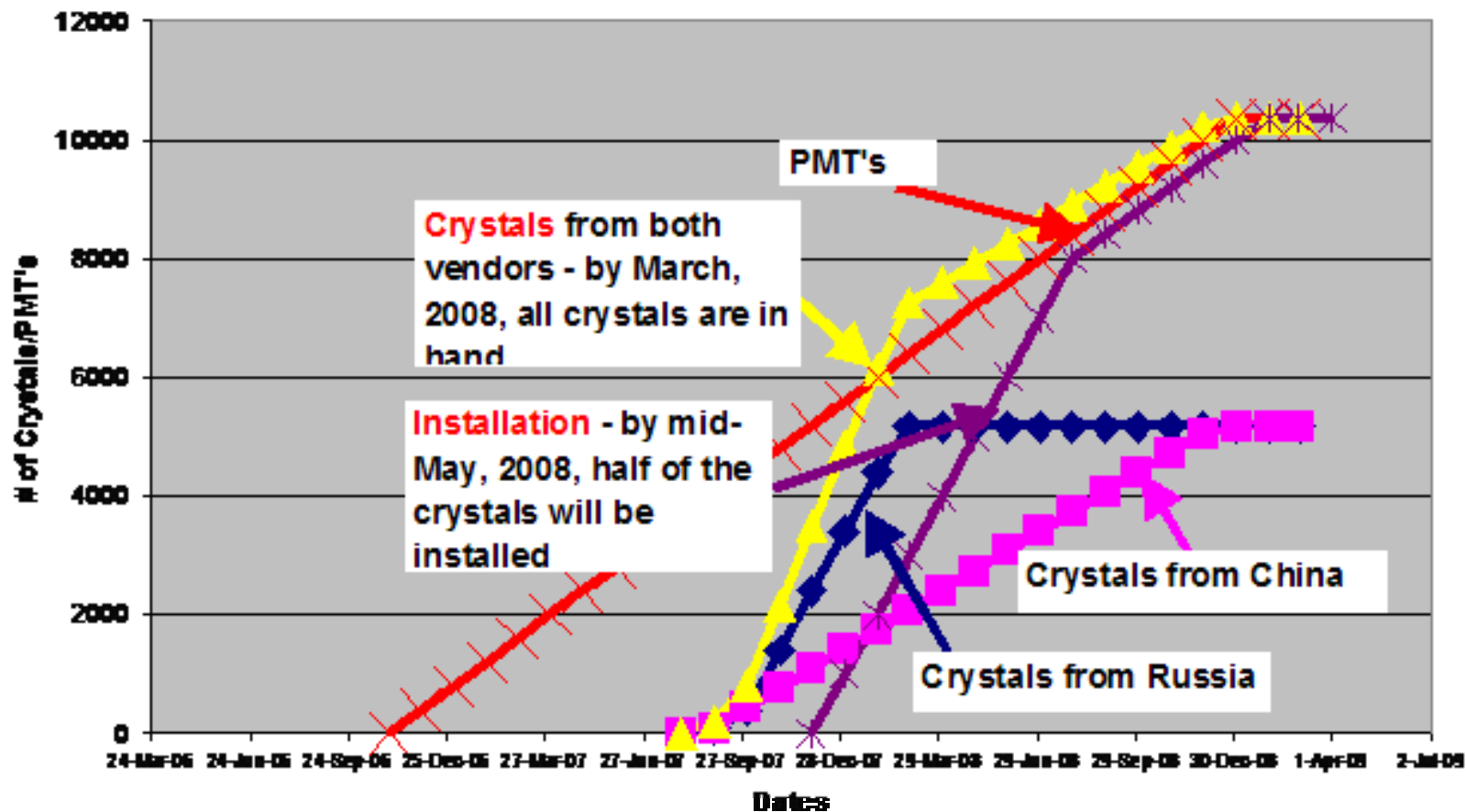
- There is concern that BTeV's procurement of PWO crystals will be delayed by CMS's procurement, which is delayed due to vendor issues
 - BTeV has tried to mitigate this problem by putting itself in a position to use as many vendors as possible, including
 - **BTCP in Bogoriditsk, Russia**
 - **Shanghai Institute of Ceramics (SIC)**
 - **Northern Crystal, Apatity, Russia**
 - We have tested crystals from all three vendors and have found them satisfactory for BTeV's requirements on resolution and radiation resistance. Radiation levels in BTeV are much lower than in CMS.
 - The world capacity, taking all these vendors into account is significantly larger than the world's demand
 - Our baseline is to use BPCT and SIC
 - If CMS uses all three vendors, our crystals production will start later but will complete very quickly once they are done
 - If CMS doesn't use one, then we will start getting their crystals earlier
-

- The concern of the CD-1 reviewers is that last part of the crystals will arrive too close to the 2009 run for us to be able to prepare them and install them successfully. Staging fixes that.
- Staging does not preclude installing the crystals in 2009 if they arrive on or near schedule
- We believe that with addition of a third vendor, there will not be any interference between CMS and BTeV

No CMS interference - default Chinese production capacity

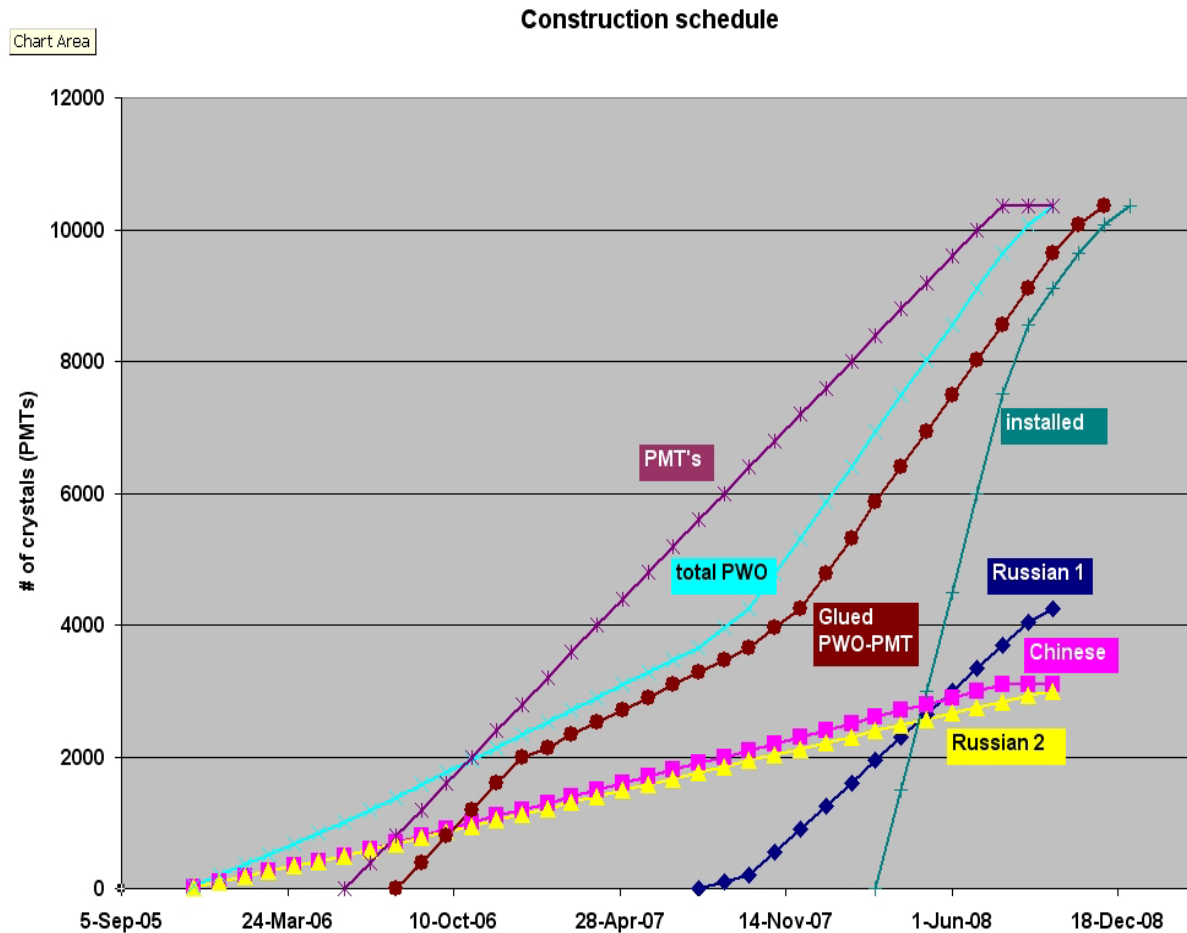


If CMS uses SIC, delaying BTeV production, but boosting production capacity at SIC



- We were also asked by DOE to submit a second report by July 1 with a schedule that doesn't need staging. The boundary conditions were
 - **Approximately the same total cost. Cost is identical to staged plan.**
 - **Freedom to move some funds forward into FY'06, FY'07, and FY'08 (but not FY'05).**
- We did submit this schedule on schedule. To achieve the goal we needed
 - **To move about \$4.0m from FY'09 to FY'06**
 - **To move about \$6.4M from FY'09 to FY'07**
 - **To move about \$0.6M from FY'09 to FY'08**
 - **To add two months to the shutdown in 2009 and use more shifts/day for installation**
 - **To pay more for lead tungstate by using a third, more expensive vendor**

We do not necessarily expect a response to this soon but it did give us a complete plan for speeding the construction up if we find ways to save money or can attract money from other sources



We would use all three vendors; we would need about \$1.2M, 0.2M, and 0.6M more in '06, '07, and '08 and less in '09, for about \$1.0M more We think by “scrubbing” the cost we can find the \$. Installation is still an issue.

- Mike Church, Accelerator Division, is in charge of IR subproject. Jim Kerby of the Technical Division is in charge of Magnet Production part.
- P5 approved BTeV without a custom IR, but suggested it. Fermilab decided to implement a custom IR based on LHC quadrupoles. This gives BTeV more luminosity and physics reach.
- The project has a WBS, a cost estimate, a schedule and an Advanced Conceptual Design Report that is evolving into a TDR
- Internal Review of the IR was held on Feb 18, 19

This design produces a β^* of 35 cm, same as at B0 and D0. BTeV luminosity will be the same as at B0/D0 when BTeV begins to run in 2009.

- The progress made on Tevatron luminosity – an increase by >2.5 in the last year, coupled with the improved β^* with the new design means that BTeV is highly likely to get the luminosity required to achieve its physics goals. This was “less certain” last year when P5 endorsed BTeV.
 - **The Recycler now works as a storage ring, is integrated into Tevatron operations, and has contributed to recent luminosity records via “Mixed Mode” running**

Luminosity at CDF for store #3657

Case	Set	Device Name	Value
HEP,	2,	C:IB0LUM,	113.292,

Luminosity at D0 for store #3657

Case	Set	Device Name	Value
HEP,	2,	C:ID0LUM,	93.571,

July 16, 2004 Luminosity 1.043×10^{32}

- BTeV has been designed and will be implemented with rapid commissioning in mind
- Because of various concerns communicated to us through the CD-1 reviewers and the PAC, we have put together a “commissioning plan.” The plan presents the unique features of BTeV’s design and specific features on BTeV’s implementation that will facilitate rapid commissioning. It includes a “strawman schedule”, similar to others BTeV members have executed in the past, for Interaction Region and Detector commissioning.
- Since “Rapid commissioning”, was largely already included in the design, it does not have any cost impact on the Construction Project budget or installation schedule.

- The BTeV IR will be (probably already is) the most carefully modeled IR Fermilab has ever designed.
- It is being built with the best technology we have ever used – including the quadrupoles FNAL developed and built for the LHC.
- All components are outside the Collision Hall. None are hanging in mid-air or buried inside the detector. The Tevatron now has a very complete and accurate survey network.
- The Tevatron is now a very well understood machine and its instrumentation will be greatly improved in the next year
- The loss and upset characteristics of the Tevatron are well understood and are being improved continually. In contrast, all these issues will have to be understood for the LHC, which has to commission the machine and characterize it, especially with respect to loss and upset patterns, and commission three Interaction Regions
- The schedule proposed is consistent with past commissioning of new and upgraded low β insertions at B0 and D0

- The key issues are for the Detector are
 - BTeV will be the only user during this period and will be able to schedule accesses and negotiate beam conditions in accordance with its commissioning needs
 - All BTeV detectors will be completely checked out before installation in the Collision Hall and immediately after they are installed. Operating parameters are all determined beforehand in very thorough tests of prototypes in test beams and in parasitic operation in C0 in 2007 and 2008.
 - The BTeV Trigger and DAQ are completely digital systems from the detector front end electronics on and their behavior can be completely studied by depositing simulated raw data generated by GEANT (including simulated defects and backgrounds) into the front end buffers. An **Integration Test Facility** that is 1/8 scale of the full system (equivalent to 1 of the 8 data highways) will be available in 2007 for complete debugging of hardware and software.
 - All online monitoring, calibration, and alignment programs will be completed and tested on Monte Carlo raw data well before data-taking.

- Commissioning has to be taken into account at every stage of the detector construction, including design, R&D, fabrication, checkout, and installation.
- Our excellent R&D program and the ability to run detectors in the test beam for long periods of time, eventually with near final electronics and software, should help us prepare for a rapid commissioning.
- We can read out individual detectors into the prototype DAQ in the test beam or in C0, a “**vertical slice**” test.
- We will be able to run all these detectors in C0, with the near-final DA components, using collisions at the end of stores as early as 2008 – a “**horizontal slice**” test

- When these conditions are met, commissioning has been very fast.
- Our goals are:
 - to commission the IR in one month. There is a detailed list of activities. This is consistent with recent experience in commissioning the last set of new IR's for CDF and D0
 - To commission the Detector in 5 weeks. We have a detailed plan from each detector and the trigger and DAQ groups. We have a “strawman” shift schedule that includes all the relevant studies, provides time for equipment repair and for continued IR tuning, and assumes about 2/3 beam availability during scheduled beam time. This schedule has been achieved by experiments that have planned properly and met the requirements stated above.

- LHCb has an uncertain schedule. Issues are not just related to first collisions but also to
 - when backgrounds are reduced to an acceptable level
 - When overall reliability and consistency of machine operations, including interference with CMS and ATLAS, is achieved
 - What instabilities and inefficiencies will occur as the machines tune for higher luminosity; and
 - What problems are associated with hotter beams going through than detector than needed for LHCb
 - **As the luminosity is increased for CMS and ATLAS, LHCb will have much hotter beams passing through its IR than needed to supply its luminosity and may suffer from serious backgrounds.**

- The Tevatron should be reasonably well understood. BTeV is not asking for more luminosity than is likely to be achieved in Run II. **Recent progress is very encouraging.**
 - We will be the primary user, which should give us a big advantage in commissioning and in steady running
 - We will have the benefit of many years of improvements to the control of beams for experiments and an understanding of how to control backgrounds
 - We can use the ability to put in large or small stores to plan a sequence of studies and corrective accesses that will be much harder for LHCb to do
 - The “upset patterns” of the Tevatron complex are well-understood. BTeV is active in simulating the upset conditions and in following the investigation of each problem. It takes real courage to put a \$20M vertex detector close to the beam and this will especially be a problem for LHCb at a new machine.

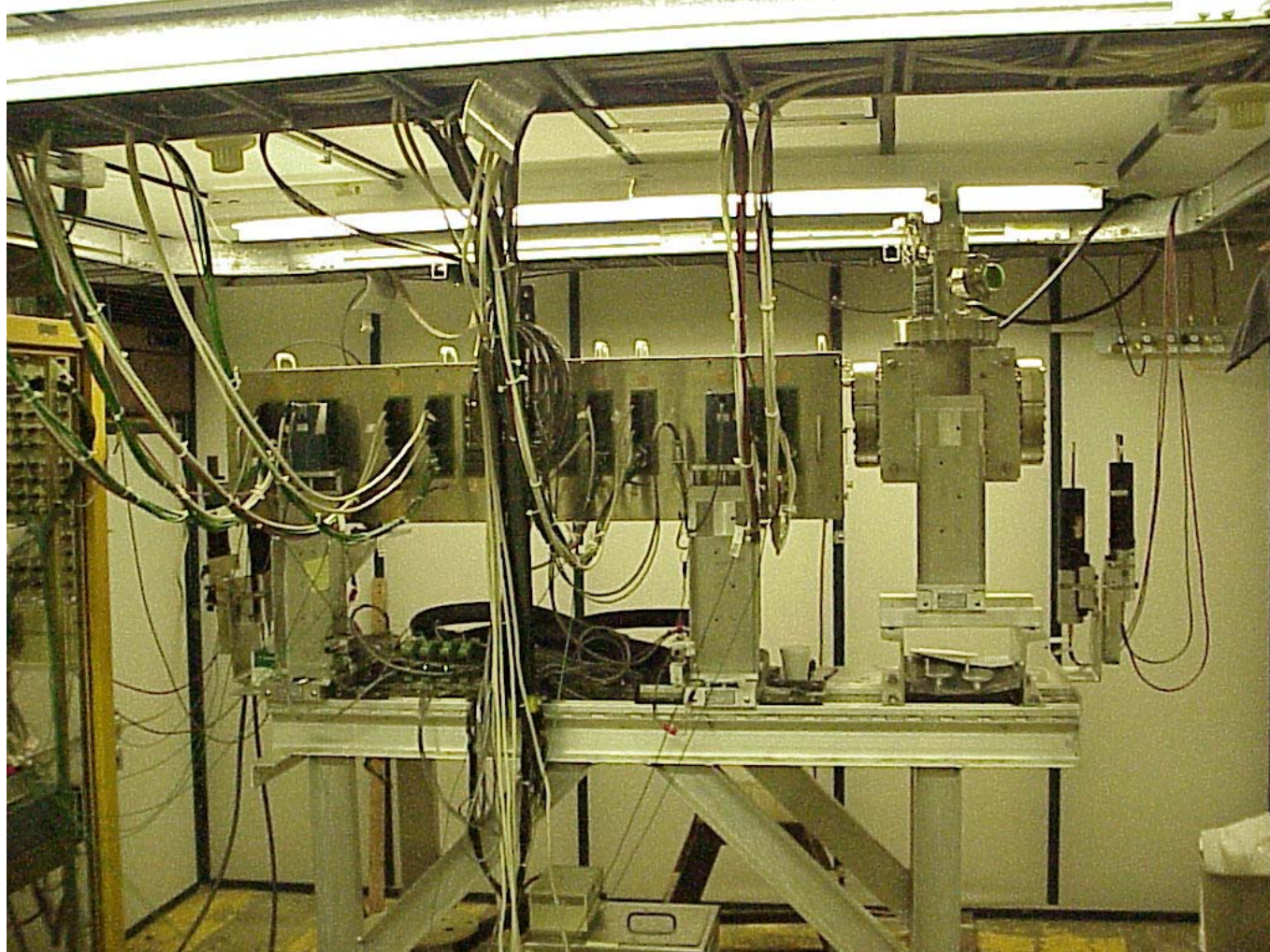
- The AD is developing an Ionization Profile Monitor one of whose major goals is to measure the beam profiles up the Tevatron Ramp. This uses QIE technology and has a real data acquisition system. They have decided to use BTeV Level 1 Buffers in their system and the same engineers working on BTeV are providing these. This will provide operational experience with these cards within a year.
- The same engineers doing the BTeV accelerator timing and control system are providing the new timing and control system for the replacement Tevatron BPM system. This system is scheduled to go into operation in the winter so we will have operational experience with the very important accelerator timing subsystem.
- We already have established a beam halo task force with AD and are studying all the various machine backgrounds both by simulation and by capturing the experience of CDF and D0. We should not be facing a wholly new situation with respect to backgrounds and machine upsets.

The more we learn about the machine and its technologies in advance, the fewer surprises we will encounter and the faster we can commission

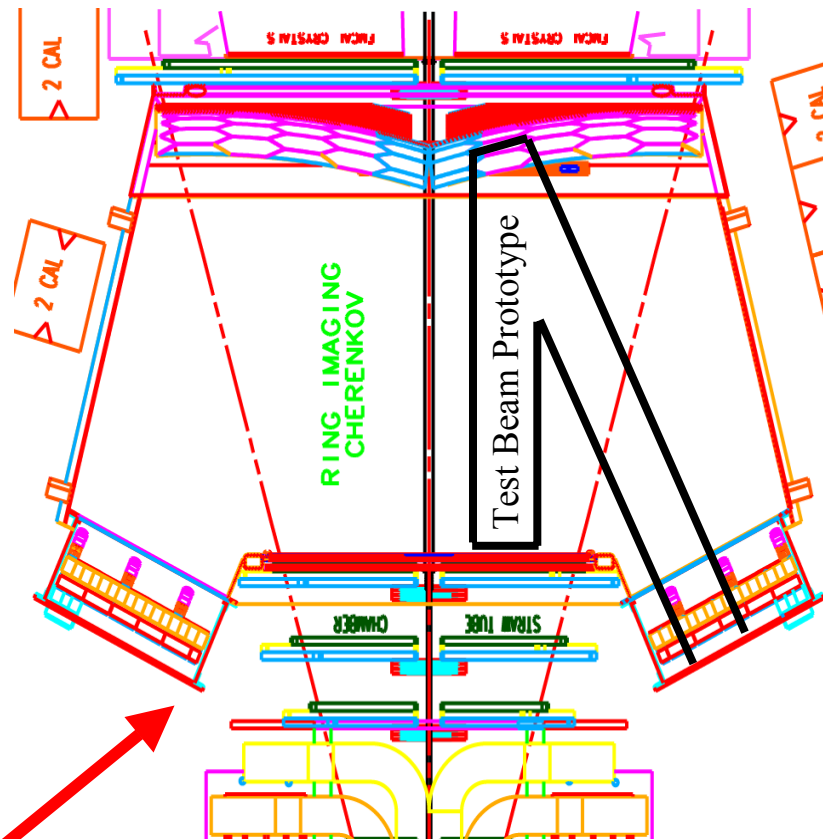
- Pixel Detector: achieved design (5-10 micron) resolution in 1999 FNAL test beam run. Demonstrated radiation hardness in exposures at IUCF. **Will have a test of almost final sensor and readout chip in FNAL test-beam, MTEST, in 2004—starting now.**
- Straw Detector: prototype built, **has been tested at FNAL in 2004,**
- **EMCAL: four runs at IHEP/Protvino demonstrated resolution and radiation hardness and verified stability of calibration system.** We would eventually like to be doing some EMCAL beam tests at FNAL and are beginning to set up the equipment in MTEST now
- RICH: Full test cell is at FNAL has been set up in MTEST now and operated with MAPMTs. **This will permit direct comparison of HPD and MAPMT.**
- Muon system tested in 1999 FNAL test beam run. Better shielding from noise implemented and bench-tested. **Design to be finalized in FNAL test starting now.**
- Silicon strip electrical and mechanical design well underway. **Prototype front end to be tested in summer/fall 2004**

Work supported by DOE/FNAL, DOE/University Program, NSF, INFN, IHEP, and others.

External View of Pixel Telescope Test Box

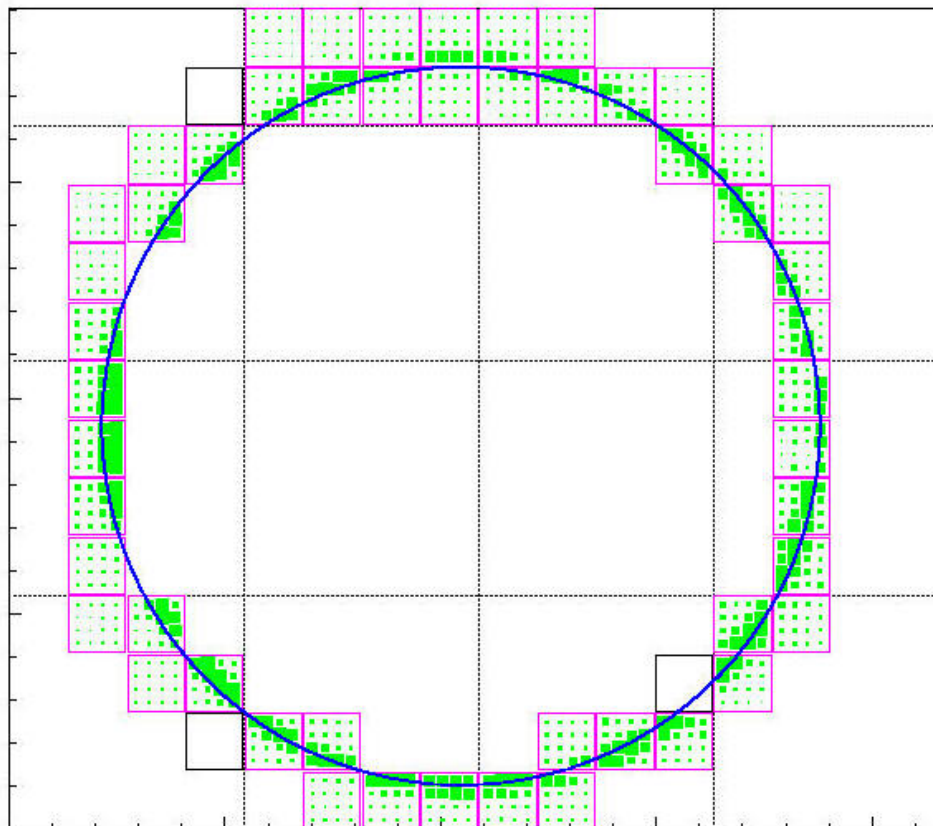


RICH Test Setup in MTEST



Relation to full detector

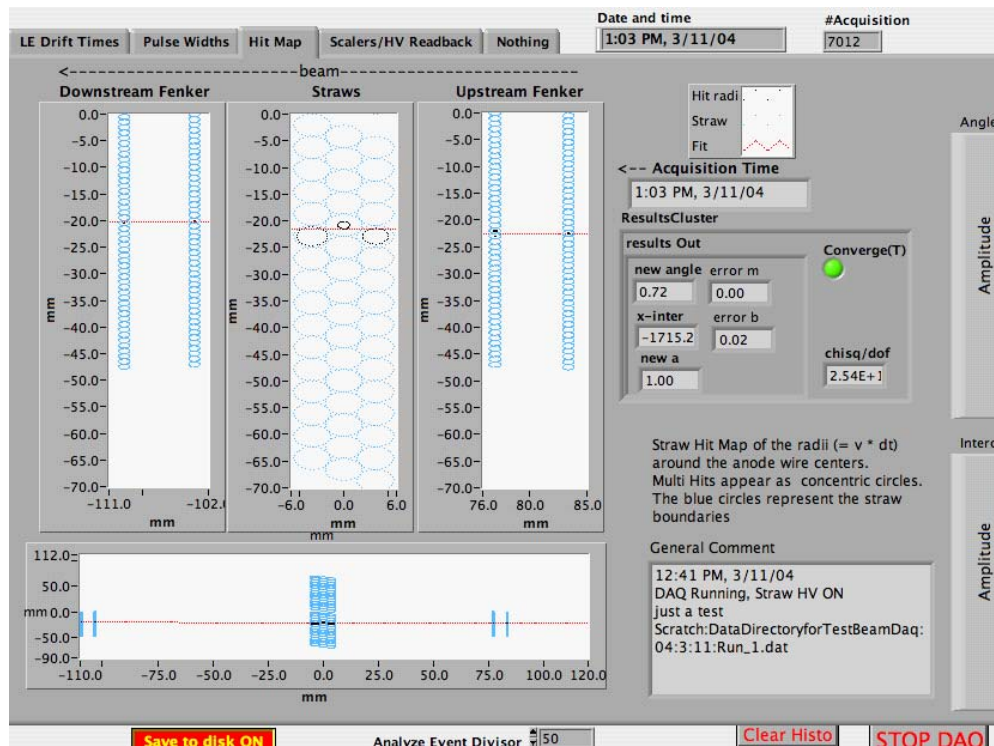
Look from The Mirror





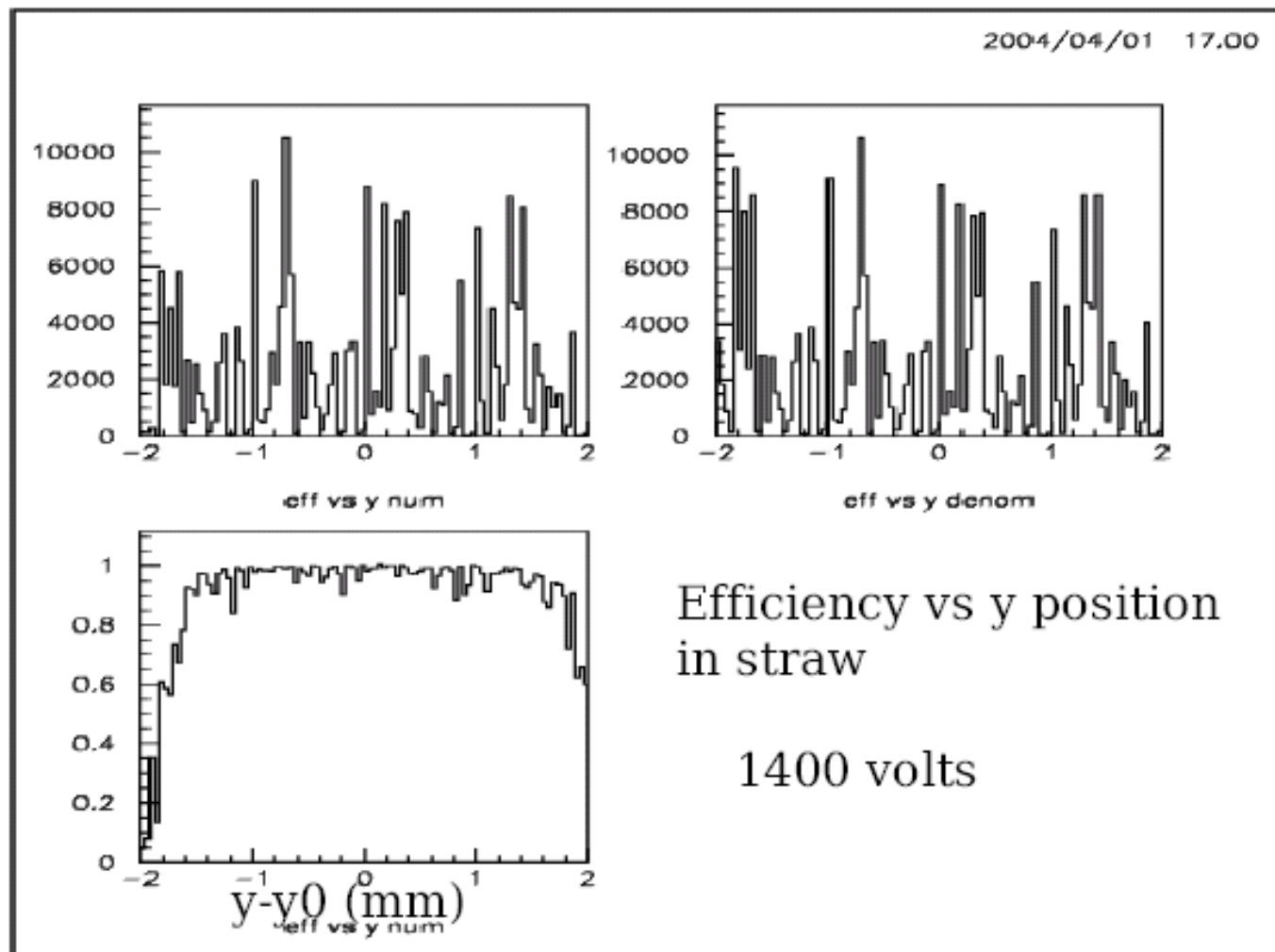


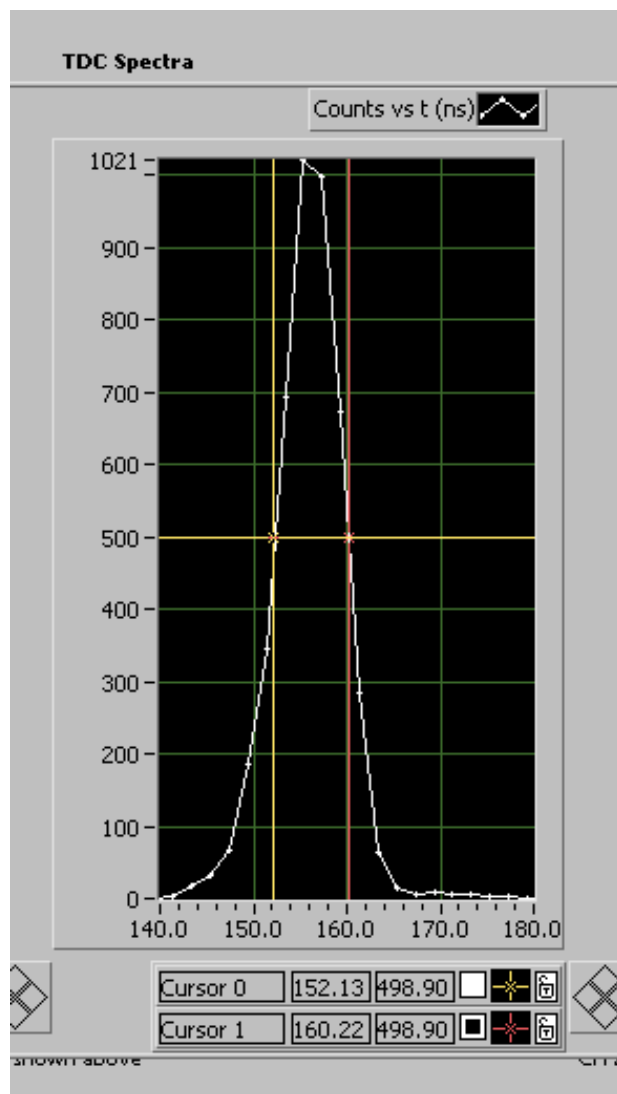
96 Straw module



Tracks recorded in
MT Slow Extracted Beam

Efficiency Plot for Straws





TDC Spectrum from previous Slide.

FWHM = 8.1 ns => 486 μ .

RMS = 206 μ .

MWPC position resolution = 144 μ .

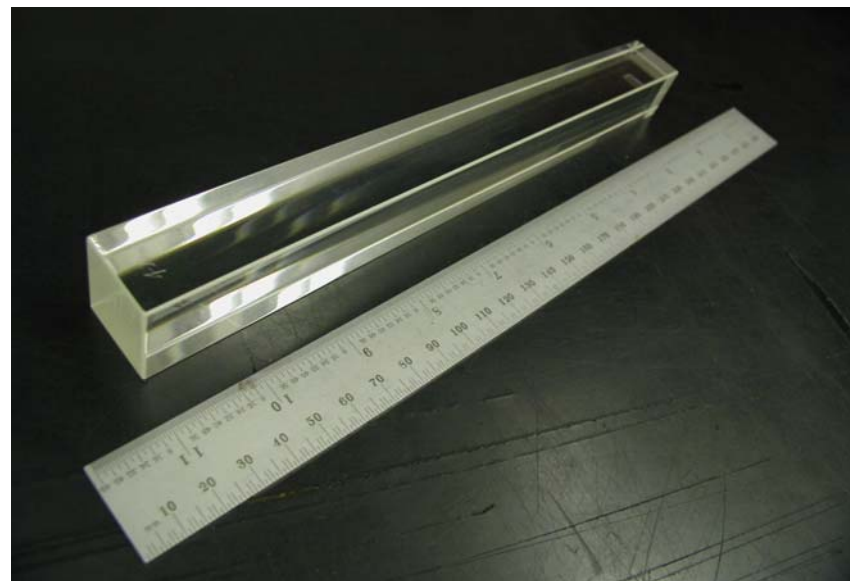
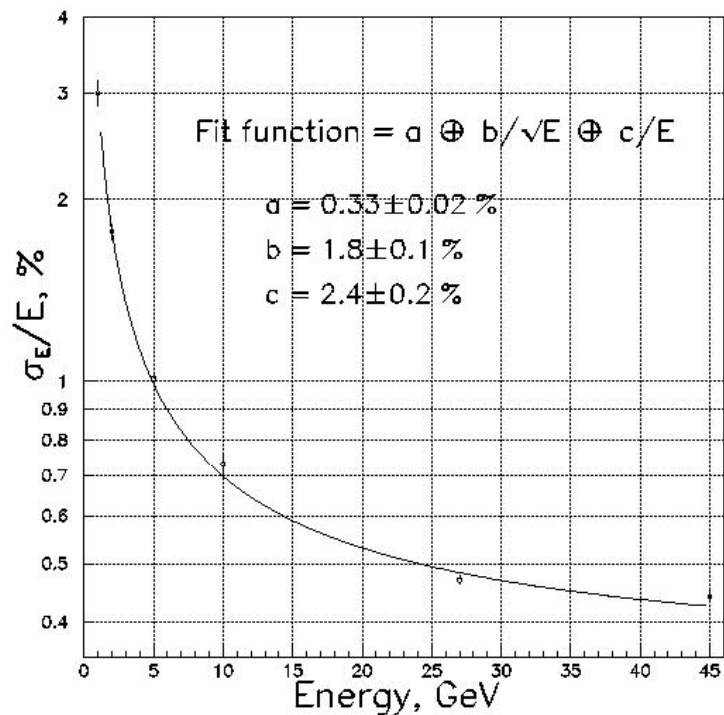
Quadrature Subtraction gives

Straw Resolution = 148 μ .

This meets the needs for BTeV
Forward Tracking.

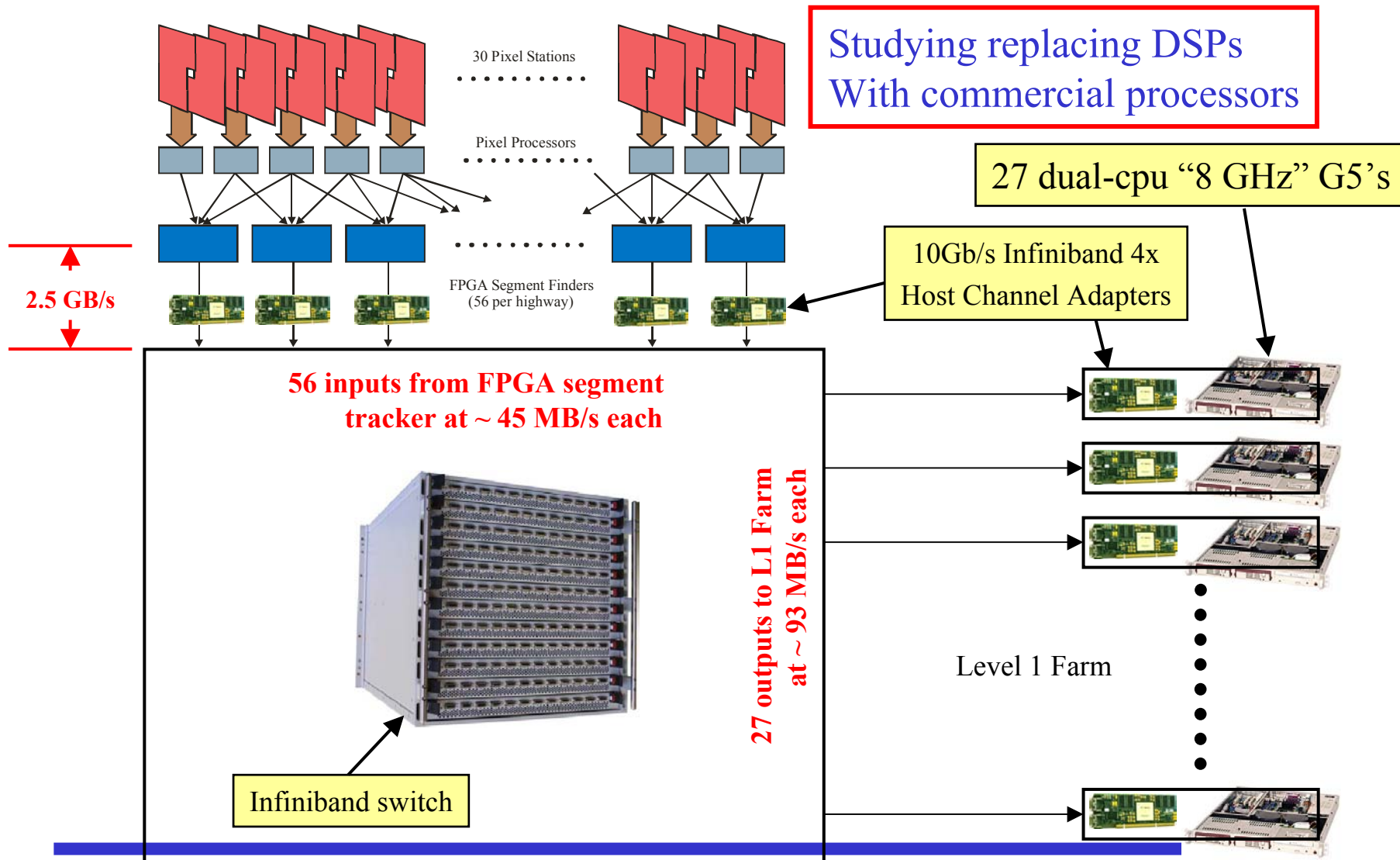
Radiation Hardness and Aging:
There have been many studies
using sources that say all will be
well. We want to test straws in
a hadron environment at IUCF
to be sure.

- There have been four runs to study the EMCAL at Protvino, under the leadership of our IHEP colleagues. In these runs they have
 - Established that we can get the required energy and position resolution
 - Studied the radiation damage properties of the crystals in hadron environments, including the damage mechanism and the recovery properties
 - Studied in detail calibration methods that will be used to maintain the performance of the detector
 - Studied crystals made by 4 different suppliers
- We plan to keep test setups at Protvino and to recreate it in MTEST

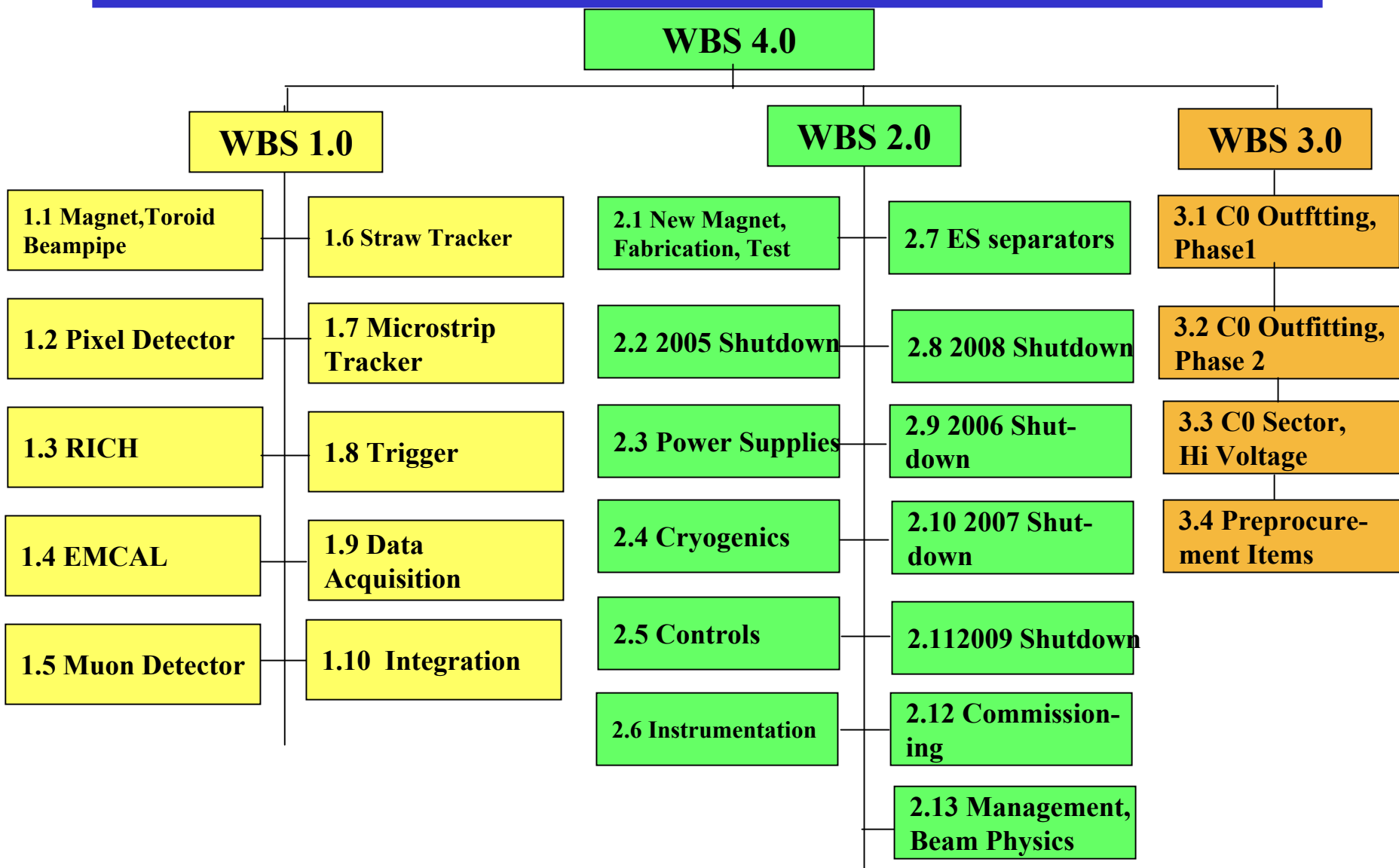


Resolution as measured in
Test beam at IHEP/Protvino.
Stochastic term = 1.8%

Conceptual design for 1 trigger highway using commodity processors:



- BTeV has a project management structure already in place, with nearly all key positions filled
 - The most recent additions have been a Scheduler (January); a Project Manager (March); and a Budget Officer (will start August 2)
 - All Level 2 and nearly all Level 3 Managers are in place
 - We still want to get an integration physicist and a procurement/quality assurance officer
- We have a complete Earned Value Project Management System (EVMS) that works with our scheduling system and the lab financials system
- We have an extensive Technical Design Report that has been quite stable for over a year. In the few places where there is still a choice of options, the choices are technically feasible and the main issue is to get the most favorable cost.



1.1 Magnets Toroids, Beam pipes (\$2.2M)

1.2 Pixel Detector (\$21.7M)

1.3 Ring Imaging Cherenkov (\$16.5M)

1.4 Electromagnetic Calorimeter (\$16.3M)

1.5 Muon Detector (\$5.1M)

1.6 Forward Straw Tracker (\$12.3M)

1.7 Forward Silicon Microstrip (\$10.0M)

1.8 Trigger (\$17.0M)

1.9 Event Readout and Control (\$16.3M)

1.10 Integration (\$10.3M)

2.0 Interaction Region (\$36M)

3.0 C0 Outfitting (\$7.2M)

Chuck Brown (FNAL)

Simon Kwan (FNAL)

Marina Artuso, (Syr)

Tomasz Skwarnicki (Syr)

Yuichi Kubota (Minnesota)

Paul Sheldon (Vanderbilt)

Alan Hahn (FNAL)

Luigi Moroni (Milan)

Erik Gottschalk (FNAL)

Klaus Honscheid, (OSU)

Margaret Votava (FNAL)

Joe Howell (FNAL)

Mike Church (FNAL)

Tom Lackowski (FNAL)

Project Management Office Staffing

- **Project Director: Joel Butler**
- **Deputy Project Director: Sheldon Stone**
- **Project Manager: Michael Lindgren**
- **Scheduler: Bill Freeman**
- **Budget Officer: Susan Pasek (starts Aug. 1)**
- **Project Electronic Engineer: Ed Barsotti**
- **Project Mechanical Engineer: Joe Howell**
- **Project Software Engineer: Margaret Votava**
- **Consultant: Bob Downing**
- **Administrative Support: Lauren Curry**

- **Integration Physicist (TBD)**
- **Procurement/ QA officer (TBD)**
- **Procurement Liaison: Joe Collins**
- **Safety Liaison: Martha Heflin**

We have work to do but will be ready to execute the project by October 1

- Complete Project Management Software System being put in place
 - **OpenPlan Scheduling Software by Welcom Co, cost and schedule. critical path, that interfaces to**
 - **COBRA software by Welcom, reporting, Earned Value, that interfaces to**
 - **FNAL Oracle Financials system**
 - **The Welcom Home software, from Welcom, provides high level reporting, dashboards, watch systems, all via a WEB Interface**
- Document Management System, including support of controlled documents and signoffs
- Many project management documents describing roles and responsibilities, procedures, and practices
- Hierarchical set of milestones aligned with DOE requirements
- Complete Technical Design Report on Detector. IR and C0 outfitting TDRs to be completed in August

We are committed to managing the BTeV Construction Project using the methods and techniques required by DOE; we are well along in this process, which is a very large effort.

1.2.2.1.7	PRC Production - FNAL	246d	02Aug2006	17Jul2006	
1.2.1.3.1	Production Sensors - FNAL	366d	10Oct2006	05Mar2007	
1.2.1.3.1.3.5	T2M: Release funds for Production pixel sensors	0	21Oct2006	21Oct2006	
1.2.2.1.7.8.3	T2M: Release fund for production pixel ROC	0	18Dec2006	18Dec2006	
1.2.1.3.1.4.2.2	Receive first batch of Production Sensors	3d	19Jan2006	23Jan2006	
1.2.1.6	Hybridization & Testing of Production Detectors	446d	24Jan2006	24Oct2007	
1.2.2.1.7.9	T5M: Receive all FPIX wafers	0	09Mar2006	09Mar2006	
1.2.1.6.1.2.2	T2M: Release funds for production pixel detector hybridization	0	24Apr2006	24Apr2006	
1.2.4.1.4	PM Production Units - FNAL	406d	02May2006	10Dec2007	
1.2.2.1.7.14	T5M: Production PRC completely tested	0	17Jul2006	17Jul2006	
1.2.1.6.1.2.7.2	T5M: first lot of pixel detectors delivered	0	26Sep2006	26Sep2006	
1.2.4.1.4.8	Assembly and Test of PM	298d	02Oct2006	05Dec2007	
1.2.3.2.3.23	T5M: all substrates ready for module placement	0	17Oct2006	17Oct2006	
1.2.1.3.1.6	T4M: Production sensors wafers completely delivered & tested	0	31Oct2006	31Oct2006	
1.2.4.3.6	Production pixel station assembly	308d	02Nov2006	28Jan2008	
1.2.4.3.6.2.9	T2M: Final pixel detector station assembly started	0	01May2007	01May2007	
1.2.4.4.8	Production pixel detector system assembly	303d	06Jul2007	18Sep2008	
1.2.1.6.1.2.8	T4M: Receive all Production pixel detectors	0	20Aug2007	20Aug2007	
1.2.1.6.5.3	T5M: All Production pixel detectors delivered & tested	0	24Oct2007	24Oct2007	
1.2.4.1.4.11	T2M: Production Pixel Module Completed	0	10Dec2007	10Dec2007	
1.2.4.3.6.8	T5M: All pixel stations assembled	0	28Jan2008	28Jan2008	
1.2.4.3.7.6	T4M: All pixel stations assembled & tested	0	04Mar2008	04Mar2008	
1.2.4.4.8.11	T5M: Pixel detector fully assembled & ready for Test	0	22Jul2008	22Jul2008	
1.2.4.4.8.12	Testing of the assembled detector at SIDET	40d	23Jul2008	18Sep2008	

This is just a fragment of the Critical Path for the Pixel Detector

- We are making excellent technical progress on the detector and the “custom” C0 IR, recommended by P5. **The Tevatron luminosity is approaching BTeV’s requirements with major upgrades still ahead**
- We will finish most of the remaining R&D in ‘04, and ‘05 and get started on final design and construction in calendar ‘05.
- We are learning invaluable lessons from the test that should help us commission the detector rapidly. We will have a complete “horizontal slice” test of the detector in MTEST and then move it to C0 in 2007/8.
- **We are working closely with AD and are mastering many aspects of running in the Tevatron well in advance of 2009.**
- **The staging allows us to compete on the same time scale as advertised. The deferred capability is unique to BTeV.**
- **BTeV is an experiment that can keep the domestic program engaged in TeV scale physics after the LHC turns on. It complements our involvement in the LHC program. It uses a machine in which we will have made a huge investment and in which progress has been very impressive. BTeV can do great physics and can do much for the US and Fermilab program.**